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(54) Self-pressurising cryogenic vessels

(57) A self pressurising cryogenic vessel includes a container 2 for cryogenic liquids from the bottom of which extends a tube 5 through which the liquid can pass and be vaporised. A regulator 7 is provided in the tube for controlling the flow of vaporised liquid through the tube and back into the upper part of the container. A by-pass valve 9 is arranged in parallel with the regulator which when opened permits of a rapid build up of pressure within the container.

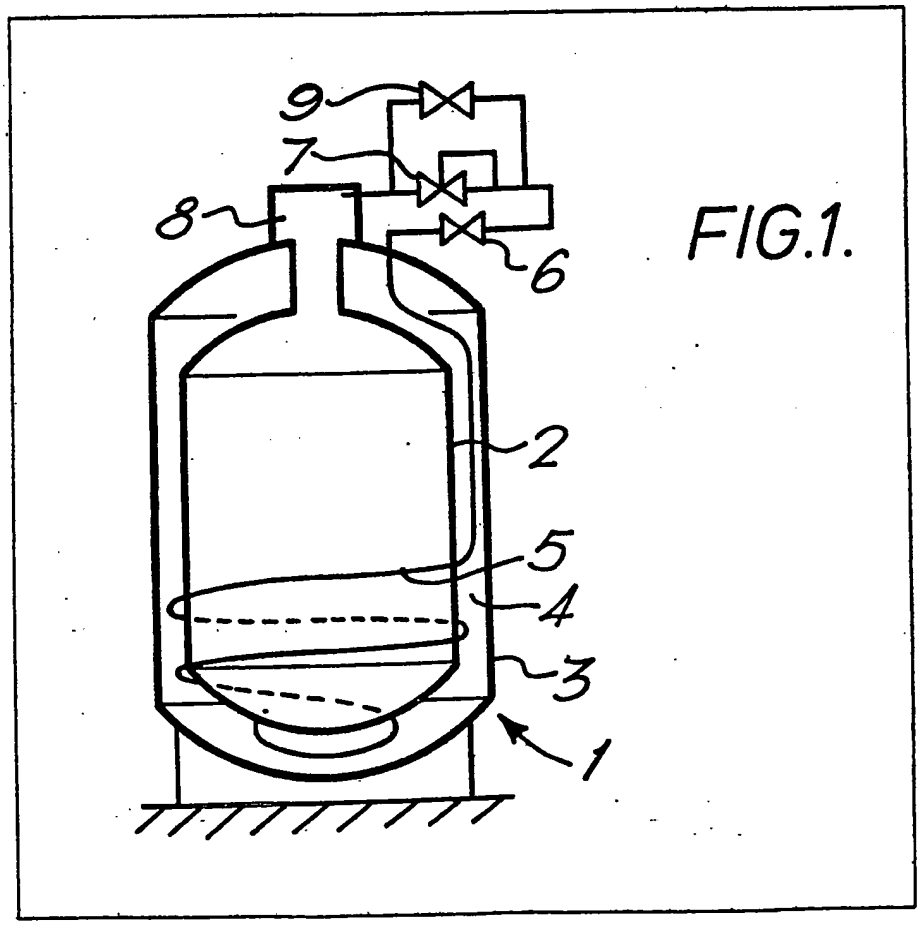

FIG.1.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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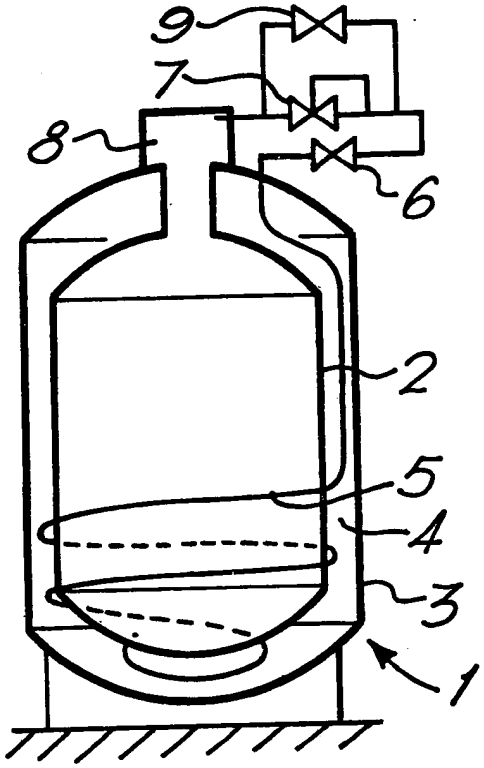


FIG.1.

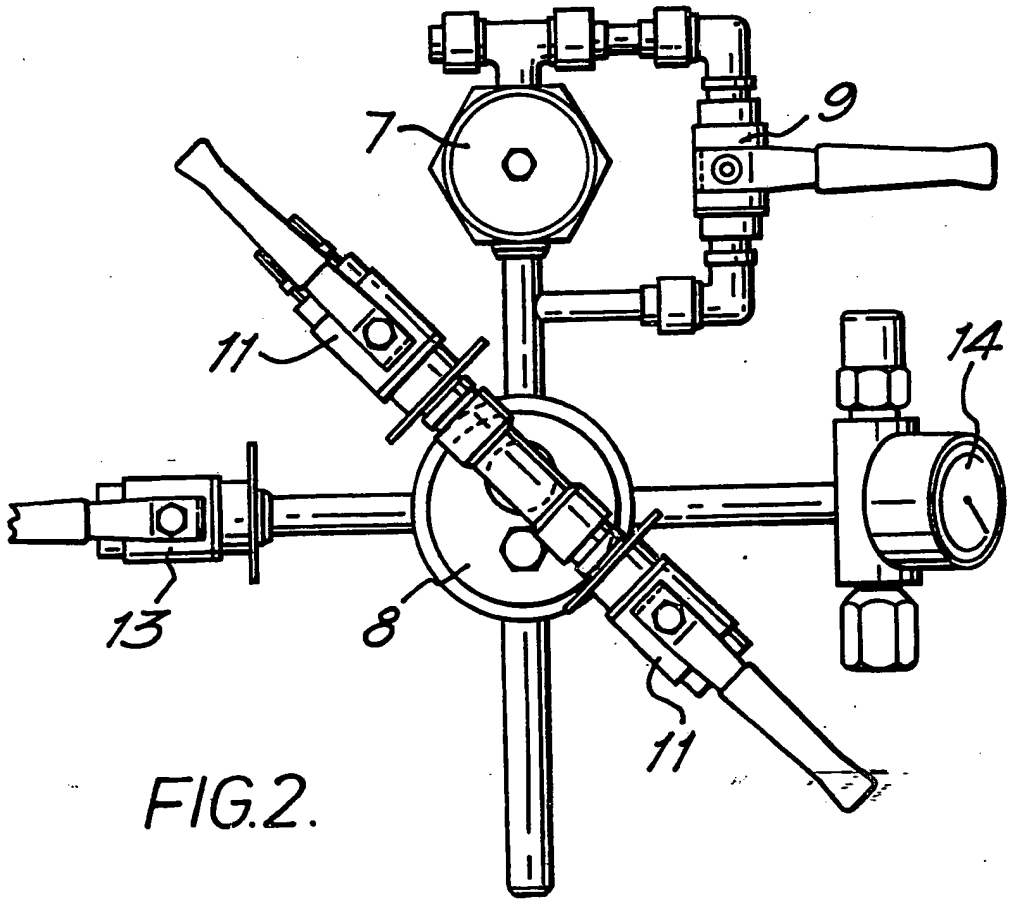
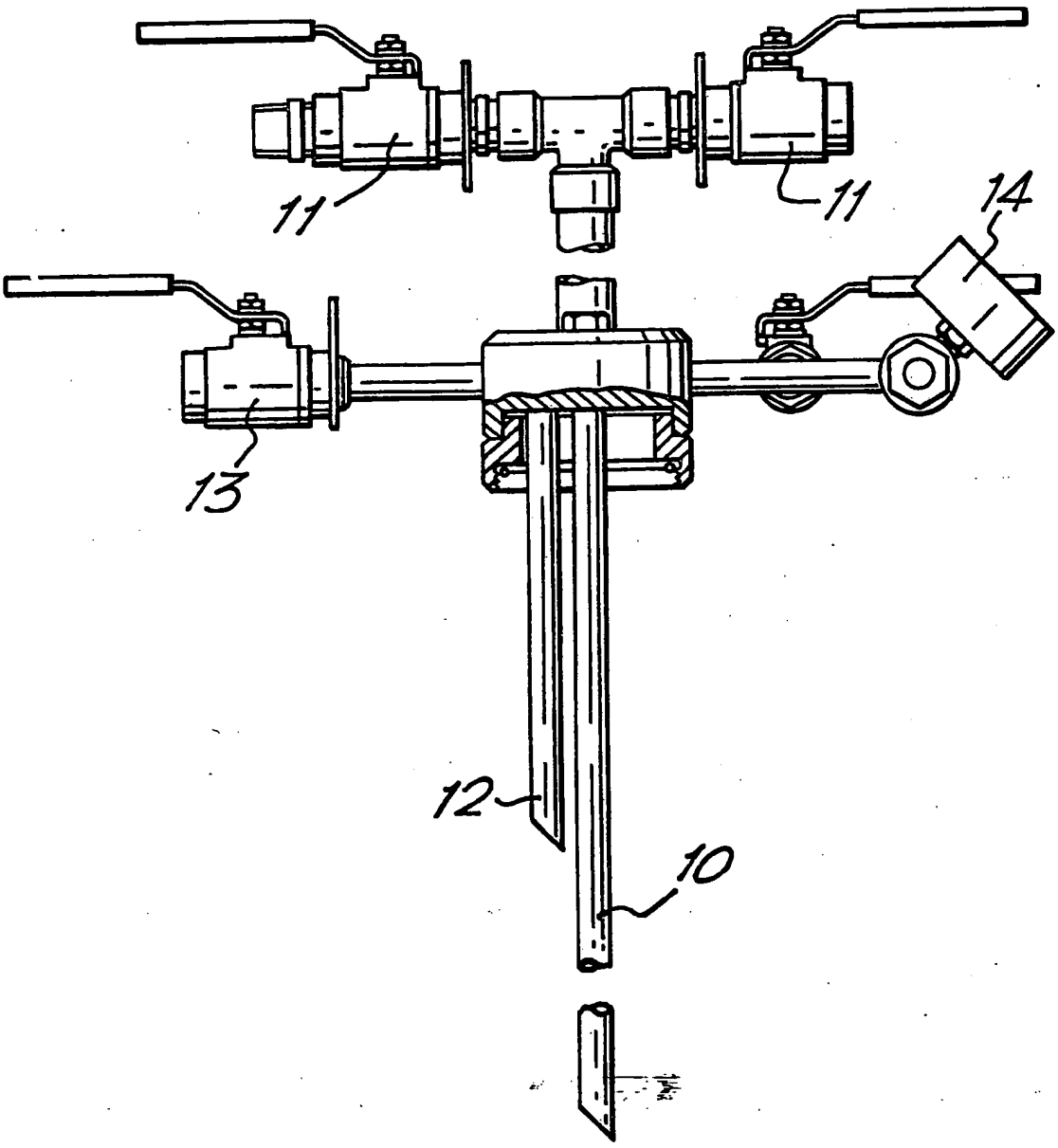


FIG.2.

FIG.3.



SPECIFICATION

Improv ments in self pressurising cryogenic vessels

The present invention relates to self pressurising cryogenic vessels.

Self pressurising cryogenic vessels are known in which cryogenic liquid such as liquid nitrogen is taken from the bottom of a container, passed through a tube where the liquid is vaporised and then fed back into the top of the container as a vapour. To control the flow of vapour back into the container, a regulator is employed in the tube.

A disadvantage of this known self pressurising cryogenic vessel is that the regulator tends to restrict the flow of vapour returning to the container and this reduces the rate of pressure build-up within the container.

According to the present invention, a vessel comprises a container for cryogenic liquids, a tube communicating at one end with liquid when in the container such that the liquid can pass through the tube and be vaporised, and at its opposite end the tube communicating with the interior of the container to return the vaporised liquid to the container, a regulator provided in the tube for controlling the flow of vaporised liquid through the tube and means including a valve providing, when the valve is opened, an alternative path for the vaporised liquid such that the vaporised liquid need not pass through the regulator on its return to the container.

Preferably, the means includes a by-pass valve arranged in parallel with the regulator.

The provision of the by-pass valve permits, when the valve is opened, of a rapid pressure build up within the container and the maintenance of pressure during a high rate of liquid decant from the container.

In a preferred embodiment, a cylinder is provided which is spaced from and surrounds the container, the tube extending from the bottom of the container into the space, at least a portion of the tube being coiled along its length around the lower end of the container so that a portion of the surface of the tube engages or is in direct proximity to the inner surface of the cylinder so that liquid in the tube is caused to vaporise.

Preferably, the tube passes through the cylinder at its upper end and the regulator and the by-pass valve are positioned between the position at which the tube passes through the cylinder and a header assembly communicating with the interior of the container and into which the tube extends.

An embodiment of the invention will now be described, by way of example, reference being made to the accompanying diagrammatic drawings in which:

Figure 1 is a schematic diagram of a self pressurising cryogenic vessel; and

Figures 2 and 3 are respectively plan and side views of a header assembly and associated valves, regulators and tubes forming part of the self pressurising cryogenic vessel in Figure 1.

As shown, a self pressurising cryogenic vessel 1 comprises an inner container 2 for holding, for example, liquid nitrogen and an outer cylinder 3 spaced from and surrounding the container 2. The space 4 between the container 2 and cylinder 3 is evacuat d. A tube 5 extends from the bottom of the container 2 into the space 4 and for a portion of its length, is coiled around the lower end of the container 2 so that a portion of the surface of the tube 5 engages or is in direct proximity to the inner surface of the cylinder 3. Outside the cylinder, a manually operable valve 6 and a pressure build regulator 7 are provided along the tube 5 which terminates at a header assembly 8 communicating with the container 2.

Arranged in parallel with the pressure build regulator 7, there is provided a regulator by-pass valve 9.

Referring also to Figures 2 and 3, extending almost to the bottom of the container 2 is a tube 10 which passes through the header assembly 8 and at its upper end, terminates at two valves 11. A second tube 12 depends from the header assembly 8 into the container 2 and communicates *via* the header assembly 8 with a valve 13 and a pressure gauge 14.

In use, when the valve 6 is open, liquid nitrogen passes from the bottom of the container 2 into the tube 5 where it vaporises due, at least in part, to the contact or proximity of the tube 5 with the inner surface of the cylinder 3. Under normal operating conditions, the gas in the tube 5 is passed through the pressure build regulator 7 which is preset to 10 psi into the header assembly 8 and hence back into the container 2. However, in the situation where a rapid pressure build up is required in the container 2, or where pressure is required to be maintained despite a high rate of liquid decant from the container 2, then the by-pass valve 9 is opened which permits the nitrogen vapour to by-pass the restriction of the regulator 7.

It will be clear that for decanting liquid nitrogen, the valve 11 will be open thereby permitting the passage of liquid nitrogen up the tube 10. The valve 13 is used to release, if necessary, the pressure of the nitrogen vapour above the liquid in the container 2.

The provision in the above described embodiment of a by-pass valve 9 permits, where conditions require it, of a rapid pressure build up within the container 2. Furthermore, during decanting of liquid nitrogen at high rates through the tube 10 and valves 11, pressure can be maintained in the container by opening the by-pass valve.

CLAIMS

1. A vessel comprising a container for cryogenic liquids, a tube communicating at one end with the liquid when in the container such that the liquid can pass through the tube and be vaporised and at its opposite end, the tube communicating with th interior of the container to return the vaporised liquid to the container, a regulator provided in the tube for controlling the flow of the vaporised liquid

through the tube and means including a valve providing, when the valve is opened, an alternative path for the vaporised liquid such that the vaporised liquid need not pass through the regulator on its return to the container.

2. A vessel comprising a container for cryogenic liquids, a tube communicating at one end with the liquid when in the container such that the liquid can pass through the tube and be vaporised and at its opposite end, the tube communicating with the interior of the container to return the vaporised liquid to the container, a regulator provided in the tube for controlling the flow of the vaporised liquid through the tube and a by-pass valve arranged in parallel with the regulator.

3. A vessel as claimed in claim 2, in which a cylinder is provided which is spaced from and surrounds the container, the tube extending from the bottom of the container into the space between the container and the cylinder, the tube, for a portion of its length, being coiled around the lower end of the container so that a portion of th surface of the tube engages or is in direct proximity to the inner surface of the cylinder so that liquid in the tube is caused to vaporise.

4. A vessel as claimed in claim 3, in which the tube passes through the cylinder at its upper end, the regulator and the by-pass valve each being positioned between the position at which the tube passes through the cylinder and a header assembly communicating with the interior of the container and into which the tube extends.

5. A vessel as claimed in any one of claims 1 to 4, in which a manually operable valve is positioned in the tube upstream of the regulator.

6. A vessel constructed and arranged substantially as hereinbefore described with reference to the and as illustrated in the Figures of the accompanying drawings.

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